

Daily GLOWBUGS

Digest: V1 #49

via AB4EL Web Digests @ SunSITE

Purpose: building and operating vacuum tube-based QRP rigs

[AB4EL Ham Radio Homepage @ SunSITE](#)

%%%% GlowBugs %%%% GlowBugs %%%% GlowBugs %%%% GlowBugs %%%%

Subject: glowbugs V1 #49

glowbugs

Monday, June 2 1997

Volume 01 : Number 049

Date: Mon, 02 Jun 1997 06:18:15 +0100

From: BOB DUCKWORTH <bob@atl.org>

Subject: Re: Electrolytic caps. needed...

Ken-

Dead PC and other switching power supplies are a good source of free HV caps. I find in the dumpster behind the local mom and pop computer store. The high side caps are generally 350volt or better and at least 220mfd. They are also physically small. In old ham RX, I usually leave the old can type caps in place, clip the HV leads, and mount these new small caps under the chassis. Keeps it looking original from the top.

- bob

Date: Mon, 02 Jun 1997 07:36:51 +0100

From: BOB DUCKWORTH <bob@atl.org>

Subject: Re: Electrolytic caps. needed...

BOB DUCKWORTH wrote:

>

> Ken-

>

> Dead PC and other switching power supplies are a good source of free HV caps.

NOTE: These supplies seldom employ bleeder resistors. I was knocked on my butt by one that was on the shelf, disconnected from power, for over a month.

If your not opposed to SS projects, the diodes are also useful along with lower voltage caps and MOSFET (sometimes).

Anyone ever looked into modifying the time constant of regulation

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'-|)-| : \ \
| | | | \ \
c_ ; c_ ; '-.. '>._

Email: ctrask@primenet.com

Graphics by Loek Frederiks

Date: Mon, 2 Jun 1997 08:54:20 -0500 (CDT)
From: mjsilva@ix.netcom.com (michael silva)
Subject: One-tuber intrigues nephew

Hi all,

Just for kicks this weekend I put together a one-tube BC receiver with my nephew. I picked a 6F8G twin triode (mostly for it's "exotic" look), and put it in a very conventional circuit (tickler-regen first stage followed by audio stage driving speaker/headphones). This was his only electronics experience beyond a "99 electronics projects" kit he once received. We built the radio on a piece of 1x4, about 8 inches long, using brads for tie points and wood screws to mount bigger components. For the tube socket I used one of my homemade socket adaptors with spring clips (a very handy way to do such quick-and-dirty work). When first powered up it was howl city, until I realized that I'd left out the RF bypass cap in the detector output. With that in place and a small hunk of wire for an antenna we got "room-filling volume" as the old magazines would say (assuming you were in a small room!).

Power was about 180 volts from a small 115:115 isolation transformer (I assume they have a slight step-up ratio to correct for transformer losses, and we weren't drawing enough current to load it down to 1:1), and a Radio Shack 6.3v job for the heater.

He was quite fascinated by the whole thing, especially the grid cap on the tube and the fact that we built it on a board. Looking forward to doing the same with my own kids in a few years.

73,
Mike, KK6GM

Date: Mon, 2 Jun 1997 07:34:14 -0700 (PDT)
From: Ken Gordon <keng@uidaho.edu>
Subject: Re: Electrolytic caps. needed...

>
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> caps. I find in the dumpster behind the local mom and pop computer
> store. The high side caps are generally 350volt or better and at least
> 220mfd. They are also physically small. In old ham RX, I usually leave
> the old can type caps in place, clip the HV leads, and mount these
> new small caps under the chassis. Keeps it looking original from the
> top.
>

Ah. I hadn't thought of that. Thanks!

Ken W7EKB

Date: Mon, 2 Jun 1997 07:49:00 -0700 (PDT)
From: Ken Gordon <keng@uidaho.edu>
Subject: Re: 12AX7

> On Sun, 1 Jun 1997, Ken Gordon wrote:
>
> > On Sun, 1 Jun 1997, William Hawkins wrote:
> >
> > > Dug out the RCA manual to see what it says about the T, U, and X7.
> > > Data sheets dated 1954, 1960, and 1961 show the following:
> > >
> > > Item 12AT7 12AU7 12AX7
> > > Max Watts 2.5 2.75 1.2
> > > Max Avg Ma - 22 -
> > > Max Volts 300 330 330
> > >
> >
> > This is HIGHLY weird since the plates in the X7 are NEARLY 3 TIMES as
> > large as those of the T7 ! By actual measurement of one of the plates
> > of each tube, I get .8625 square inches of area for each plate in the
> > 12AX7 and .375 square inches of area for each plate in the 12AT7.
> >
> I just looked over the more authoritative Sylvania manual, and
> the numbers concur.
>

OK. But something is still screwy. A tube with less than HALF the plate area of another cannot possibly provide over twice the power output, all else being equal.

Perhaps the T7 data is for both sections, and the X7 data is for EACH section ? Although that still isn't totally correct concerning the observed plate areas, it is better.

> >
> > Further, from the data above, the 12AU7 at 22 ma at 330 volts is 7.26
> > watts max. average power, not 2.75 watts.
> >
> If you were to run it that way, yes it would. But you would
> have to reduce either the plate voltage or current in order to comply
> with the maximum dissipation spec. Just because 330 volts and 22mA is
> the maximum plate rating for voltage and current does not mean that you
> can operate it under those conditions. You have to observe all specs
> at all times.

You are correct of course. I was mistaken.

Plate areas STILL don't add up when compared to the published data.

Ken W7EKB

Date: Mon, 2 Jun 1997 08:13:31 -0700 (MST)
From: Chris Trask <ctrask@primenet.com>
Subject: Re: One-tuber intrigues nephew

```
> Hi all,  
>  
> Just for kicks this weekend I put together a one-tube BC receiver with  
> my nephew. I picked a 6F8G twin triode (mostly for it's "exotic"  
> look), and put it in a very conventional circuit (tickler-regen first  
> stage followed by audio stage driving speaker/headphones). This was  
> his only electronics experience beyond a "99 electronics projects" kit  
> he once received. We built the radio on a piece of 1x4, about 8 inches  
> long, using brads for tie points and wood screws to mount bigger  
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> I'd left out the RF bypass cap in the detector output. With that in  
> place and a small hunk of wire for an antenna we got "room-filling  
> volume" as the old magazines would say (assuming you were in a small  
> room!).  
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> Power was about 180 volts from a small 115:115 isolation transformer (I  
> assume they have a slight step-up ratio to correct for transformer  
> losses, and we weren't drawing enough current to load it down to 1:1),  
> and a Radio Shack 6.3v job for the heater.  
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> He was quite fascinated by the whole thing, especially the grid cap on  
> the tube and the fact that we built it on a board. Looking forward to  
> doing the same with my own kids in a few years.  
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> 73,  
> Mike, KK6GM  
>
```

This is the sort of experience that gets kids interested in electronics, and will hopefully keep them from becoming computer programmers. Sure glad to see that someone will take the time to do this and get kid's interest while they're at an impressionable age.

Chris

Chris Trask / N7ZWY
Principal Engineer
ATG Design Services
P.O. Box 25240
Tempe, Arizona 85285-5240

Email: ctrask@primenet.com

Graphics by Loek Frederiks

Date: Mon, 2 Jun 1997 08:41:40 -0700 (MST)
From: Jeff Duntemann <jeff.duntemann@coriolis.com>
Subject: High voltage in a PC power supply (was: Re: Electrolytic caps. needed...)

At 07:36 AM 6/2/97 +0100, you wrote:

>BOB DUCKWORTH wrote:

>>

>> Ken-

>>

>> Dead PC and other switching power supplies are a good source of free HV

>> caps.

>

>NOTE: These supplies seldom employ bleeder resistors. I was knocked on

> my butt by one that was on the shelf, disconnected from power,

> for over a month.

Good grief! What the heck is high voltage DC doing inside a PC power supply!?!?!?!?

(And the corrolary question: Could selfsame DC be harnessed for glowug purposes?)

- --73--

- --Jeff Duntemann KG7JF
Scottsdale, Arizona

Date: Mon, 2 Jun 1997 11:08:55 -0500 (CDT)
From: mjsilva@ix.netcom.com (michael silva)
Subject: Re: One-tuber intrigues nephew

Chris wrote:

>

>On Mon, 2 Jun 1997, michael silva wrote:

>

>> Hi all,

>>

>> Just for kicks this weekend I put together a one-tube BC receiver

>>with my nephew.

<...details omitted...>

>Wow!

> This is the sort of experience that gets kids interested in
>electronics, and will hopefully keep them from becoming computer pro-
>grammers. Sure glad to see that someone will take the time to do
>this and get kid's interest while they're at an impressionable age.

Alas, Chris, 'taint so. For, you see, I was doing these things when I was a kid (they didn't work quite as well, though), and yet I have become a programmer. If it helps, I program *embedded* systems, where I actually make the electrons get a real job <g>.

73,
Mike, KK6GM

Date: Mon, 02 Jun 1997 12:37:59 +0100

From: BOB DUCKWORTH <bob@atl.org>

Subject: Re: High voltage in a PC power supply (was: Re: Electrolytic caps. needed...)

> Good grief! What the heck is high voltage DC doing inside a PC power
> supply!?!?!?!?
>
> (And the corrolary question: Could selfsame DC be harnessed for glowug
> purposes?)
>

Jeff-

It comes in via that umbilical thing you hook to the power company ;-)

The 110VAC or 220VAC comes in to a rectifier via some noise filtering.

Two kinds of supplies common in dumpsters.

Older have a jumper to go from 1/2 wave for 220V to full wave for 110V
and use lower voltage caps. Newer 'universal power' units go straight
to bridge, no matter the input voltage.

Higher voltage transistors and lower value caps cost less than
switch plus higher value caps (neccesary for filtering the 50Hz after
it goes through a half wave).

There are others but these are the ones I see most of in the dumpster.

220 to 240 VAC through full wave and you need 370 volt caps.

This DC then gets pulse width modulated to drive a transformer or
autotransformer or inductor with pulse width controlled buy a little
doo-dad that monitors the output voltage and adjusts pulse width to keep
it constant as current demands change.

BTW, the caps used in the PC supplies are pretty cheap and plentiful
as surplus and if you look in the cap manufacturers catalogs you can
pick the popular values by the price dip at those values.

I'm sure you could use the high side after running through an isolation
transformer. Remember, one side is connected to the AC line (although
maybe through a couple of diodes).

- bob
wb4mnf

Date: Mon, 2 Jun 1997 12:13:58 -0500 (CDT)

From: Bob Roehrig <broehrig@admin.aurora.edu>

Subject: Re: High voltage in a PC power supply (was: Re: Electrolytic caps. needed...)

On Mon, 2 Jun 1997, Jeff Duntemann wrote:

> >> Dead PC and other switching power supplies are a good source of free HV
> >> caps.
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> > my butt by one that was on the shelf, disconnected from power,

> > for over a month.

>

> Good grief! What the heck is high voltage DC doing inside a PC power
> supply!?!?!?!?

PC switching supplies first rectify the AC line voltage, then goes to the
switching circuitry before going to any transformers. This voltage is
not isolated from the AC line.

E-mail broehrig@admin.aurora.edu 73 de Bob, K9EUI
CIS: Data / Telecom Aurora University, Aurora, IL
630-844-4898 Fax 630-844-5530

Date: Mon, 02 Jun 1997 12:25:33 -0700
From: "R. Eric Sluder" <sludere@gte.net>
Subject: re: FT243 to HC-6 - gratitude!

Well folks as always you all came through 599. I now have all kinds of
ideas on how to adapt a FT243 to a HC-6 holder! Of course after posting
the request I "rechecked" the DX-60 by actually removing it from the
operating bench so I could see the sockets and lo and behold three out
of the four are for FT243's!! I guess when I reached back there earlier
(with the power off) and pulled out a HC-6 rock I just jumped to the
conclusion that all the sockets were for HC-6's..duh But, I'll store
everyone's advice away for when I do need to make that conversion.

Thanks for the advice.

73,
Eric
- --

~~~~~  
R. Eric Sluder, KB9BGS  
3339 Eden Way  
Carmel, IN 46033-3070 USA  
<><  
~~~~~

Date: Mon, 2 Jun 1997 10:25:23 -0700 (PDT)
From: Ken Gordon <keng@uidaho.edu>
Subject: WTS for friend...

A friend has a Globe King 500 transmitter for sale. If anyone is
interested, I will find out details and post here. The transmitter is
presently in use. As I remember it, it is the version with the built in
VFO in a central rack panel. It is completely rack mounted with modulator
and power supplies.

Please post replies to me here. Thanks.

Ken W7EKB

Date: Mon, 2 Jun 1997 13:33:00 -0400 (EDT)

From: Bruce Robertson <brucero@chass.utoronto.ca>
Subject: [none]

postpone glowbugs

Date: Mon, 2 Jun 1997 13:08:43 -0500 (CDT)
From: Spencer Petri <spetri@e-tex.com>
Subject: Cornell Electronics-Tubes!

Hello Tubsterites!

After some questions to me about the above company, I sent off a dollar to them for a new price list which came today. Yes, they still offer 89 cent tubes. some of these are:

6AC7-6AG5-6AG7(HEY!)-6AH6-6AL5-6AM8-6AS8-6AT6-6AU4(For 100V Types)-6AU5-6AX4-6BC5-6BH8-6BN8(WOW!)-6BQ6-6CB6--6CE5-6CF6-6DX8-6J5-6JH6-6JH8(Replace that 7360)-6K6-6S4-12DQ6-12GN7(Great Multiplier and Amp)-12L6-25L6 and a bunch more.

I've bought from Cornell over the years and have been happy with the results.

No connection other then they took my money and I got tubes in return.

Send a dollar and get their poop. Calling brings few results.

Cornell Electronics Company
4217 University Avenue
San Diego, CA 92105
(619)281-9792

73 de Pete WA5JCI

EM-21--6 Mtr -- WAS #490, WAC CW, DXCC/91 Countries, VUCC #361/618 Grids

2 Mtr -- 36 States -- VUCC #346/183 Grids

Date: Mon, 2 Jun 1997 11:33:01 -0700 (PDT)
From: Ken Gordon <keng@uidaho.edu>
Subject: Stuff...

I just aquired a boatload of old computer parts (XT, AT vintage) including HD controllers, HD, 2400 and 1200 baud modems, etc. Anyone need anything to complete their packet set up or computer?

You pay shipping.

If no one here wants anything, the stuff is probably going to the dump.

(I SINCERELY apologize for taking up BA space to get rid of sand based junk, but thought you guys ought to get first dibs, if you will stoop so low!:-))

Date: Mon, 2 Jun 1997 16:26:17 -0400 (EDT)
From: leeboo@ct.net (Leon Wiltsey)
Subject: BOOK RATE

>To: ba
>From: leeboo@ct.net (Leon Wiltsey)
>Subject: BOOK RATE
>Cc:
>Bcc:
>X-Attachments:
>
>Hi Gang
> thought I would pass this on,
>if you are going to send any printed material to
>a ham friend, for cry eye dont send it book rate, by snail mail.
>I traded a newer copy af the rad. am hndbk for an older one
>someone else wanted to get rid of. Sent mine byeg mail, it arrived
>in 4 days. Stilll waiting for the one that was sent me 3 weeks ago
>BOOK RATE BY SNAIL MAIL!!!!
>.
>

68 yr old semidisabled senior
(stroke got my balance & hand to eye coordination)
ham agn as KF4RCL TECK+ (MUCH HAPPINESS)
BUILD MOST OF MY STATION EQUIP
SUB.BA & GB
(tubes that is no SOLID STATE)

Leon B Wiltsey (Lee)
4600 Lake Haven BLVD.
Sebring, Fl. 33872

SEBRING FL. THAT WONDERFUL PLACE WHERE THERE IS NO QRM
FROM ANYTHING LOCAL

Date: Mon, 2 Jun 1997 16:58:48 -0400 (EDT)
From: leeboo@ct.net (Leon Wiltsey)
Subject: BOOK RATE

>Date: Mon, 2 Jun 1997 16:25:57 -0400 (EDT)
>Reply-To: leeboo@CT.NET
>Sender: owner-boatanchors@theporch.com
>From: leeboo@CT.NET (Leon Wiltsey)
>To: BOATANCHORS@sco.theporch.com
>Subject: BOOK RATE
>X-Sender: leeboo@ct.net
>X-Listprocessor-Version: 8.1 -- ListProcessor(tm) by CREN
>
>Hi Gang
> thought I would pass this on,
>if you are going to send any printed material to
>a ham friend, for cry eye dont send it book rate, by snail mail.
>I traded a newer copy af the rad. am hndbk for an older one
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Leon B Wiltsey (Lee)
4600 Lake Haven BLVD.
Sebring, Fl. 33872

SEBRING FL. THAT WONDERFUL PLACE WHERE THERE IS NO QRM
FROM ANYTHING LOCAL

Date: Mon, 2 Jun 1997 16:59:26 -0600
From: dfrancis@iex.net (Dexter Francis)
Subject: Foothill gathering of (b)eagles?

Greetings -

It's begun to look like there will be a (small?) group of BA types meeting at the hotdawg/donut hut at the June Foothill Swap meet. Current plans are to congregate at 0800 hours. I'm working on getting the two meter talk in freq. and will pass it on for those who dare carry palm sized silicon based life forms. Perchance we ought to all go AM and really fry the FM silisolistaters, eh?

What was the conclusion on the AM 2 meter frequency discussion?

Y'all be welcome, Aye. Pass the fire bottles and praise the commutation.

- -df

* CWest Tube Sales - P.O.B. 22443 SLC, UT 84122 *
* http://www.usa.net/~dfrancis/CWest_Tube_Sales.html *

*

73, Bill W7TI

I don't know about "...much higher..." According to the handbook, the X7 has an amp.factor of 100, the T7 has one of 60, and the U7 of 17-19.5.

I didn't know that the "fine-ness" of the grid structure controlled amp.factor as much as distance-from-plate vs closeness-to-cathode.

[illegible]

I have made up my mind to make a neutralized, push-pull, class B, linear RF amp using a 12AX7 just to see what empirical results I get.

This will have link-coupled, tuned, input and output, capacitive cross-neutralization, and I will put it on 7050 for testing. I will use my regulated high voltage powersupply and will check everything check-able, and will drive it with a crystal osc/buffer made with a 12AT7. It will have regulated fixed bias too, and I'll key everything necessary in the cathode.

Lessee...4 variable caps, two coils, two rf chokes, 1 socket, 4 bypass caps. That takes care of the amp.

I'll probably need a 1000 cfm blower to keep it cool though. Anyone happen to have a spare refrigeration unit? :-)

Wish me luck! Hee hee!

Ken W7EKB

Date: Mon, 2 Jun 1997 21:21:05 +0000
From: "Brian Carling, Radio AF4K" <bry@mnsinc.com>
Subject: Plate xfmrs (Was: Electrolytic caps. needed...)

On 2 Jun 97 at 7:36, BOB DUCKWORTH spoke about Re: Electrolytic caps. needed... and said:

```
> Anyone ever looked into modifying the time constant of regulation
> feedback loop and using an audio signal as reference to turn one of
> these into a 150W audio amp (modulator :-)?
```

Now THAT sounds like fun!

On a similar topic, I wonder if ANYONE on here has tried using the old transformer out of a microwave oven as a PLATE SUPPLY for a half KW RF amplifier? I am thinking I could get enough out of one of those for many hundred volts, perhaps even 1-2000 V DC for an amplifier here.

If you say it HAS been done, my next idea is to start calling around to all of the repair places or looking in their dumpsters!

WATSAY?

I have some NICE NIB Sweep Tubes here just waiting to be built into a 500 watt final!

Bry

*** 73 from Radio AF4K/G3XLQ Gaithersburg, MD USA *
** E-mail to: bry@mnsinc.com *
*** See the interesting ham radio resources at: *
** <http://www.mnsinc.com/bry/> *

Date: Mon, 2 Jun 1997 21:21:05 +0000
From: "Brian Carling, Radio AF4K" <bry@mnsinc.com>
Subject: Re: WTS for friend...

I am interested in the Globe King.

What state is it in?

Which one is it? There was a Model 400 that used
V-70-D triodes in the final, that was hard to tame,
and the later model 500 using some newer tube type,
which may be better. Either way I am interested
and would like to discuss acquiring said Boat Anchor!

bry@mnsinc.com

(301) 990-6070

Brian C. (AF4K)

On 2 Jun 97 at 10:25, Ken Gordon spoke about WTS for friend... and
said:

> A friend has a Globe King 500 transmitter for sale. If anyone is
> interested, I will find out details and post here. The transmitter
> is presently in use. As I remember it, it is the version with the
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> Ken W7EKB

>

>

*** 73 from Radio AF4K/G3XLQ Gaithersburg, MD USA *
** E-mail to: bry@mnsinc.com *
*** See the interesting ham radio resources at: *
** <http://www.mnsinc.com/bry/> *

Date: Mon, 2 Jun 1997 18:47:50 PST
From: dwink@juno.com (Daniel C Winkler)
Subject: Re: 12AX7...

Hi gang,

The 12AX7 has a plate dissipation of 1.2 watts per
triode, or 2.4 watts per tube. Class B amplifiers are
almost never single ended, so the specs in the handbook

are probably for a push-pull pair. The duty cycle in a speech amplifier is only about 25%, so there is no reason that a 12AX7 couldn't put out 7.5 watts as a push-pull class B audio amplifier in amateur service. The plates may dissipate more than 1.2 watts on peaks, but the overall average will be ok. A sine wave for an extended period would probably make your plates glow, but isn't that what "Glow" bugs really refers to????

Fact is, Sandy DID it, and it worked.

In class C, efficiencies of 75% are not uncommon, so again, 7.5 watts RF from a single 12AX7 is not out of the question. Who needs more than 5 watts, anyway?

The 40ma plate current is peak. Gotta watch them little superscripts in the tables. I think the Handbook guys just forgot the (3) superscript (= two tubes in push-pull) on the 7.5 watt output spec.

Dan Winkler N7IVR Seattle WA

Date: Mon, 02 Jun 1997 18:53:54 -0700
From: Bob Rolfness <rsrolfne@atnet.net>
Subject: Re: Plate xfmr (Was: Electrolytic caps. needed...)

Brian Carling, Radio AF4K wrote:

>
> On 2 Jun 97 at 7:36, BOB DUCKWORTH spoke about Re: Electrolytic
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> *** 73 from Radio AF4K/G3XLQ Gaithersburg, MD USA *
> ** E-mail to: bry@mnsinc.com *
> *** See the interesting ham radio resources at: *
> ** <http://www.mnsinc.com/bry/> *

> *****

Bry - Go for it. Its been and is being done. Check out several units.
You may find a transformer where the windings are sperated [primary on one side, seconday on the othe] Its easy to remove the secondary and rewind it to any voltage you want. The number of turns, count the turns used for the filament winding and that gives you the "turns per volt". Size of wire to use, check an old handbook on load capacity of various sizes of wire. Remember, E times I of your winding must be less or equal to the power capacity of the original stove or the core and primary winding. [900 watts or so.] But can be pushed a little for SSB amateur service. Also don't forget to insulate the new winding, and the several layers you will need.

Try a filmant transformer first. Winding transformers is fun and not that hard. A skill learned by maney old hams from the days when money was tight and more time was available. :-)

Good luck,

73's Bob W7VZX

Date: Mon, 02 Jun 1997 19:25:32 -0700
From: Gerald Caouette <ve6nap@oanet.com>
Subject: Re: 12AX7 and tube ratings

Ken Gordon wrote:

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> On Sun, 1 Jun 1997, William Hawkins wrote:
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> > Dug out the RCA manual to see what it says about the T, U, and X7.
> > Data sheets dated 1954, 1960, and 1961 show the following:
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> > Item 12AT7 12AU7 12AX7
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> This is HIGHLY weird since the plates in the X7 are NEARLY 3 TIMES as
> large as those of the T7 ! By actual measurement of one of the plates
> of each tube, I get .8625 square inches of area for each plate in the
> 12AX7 and .375 square inches of area for each plate in the 12AT7.
> Further, from the data above, the 12AU7 at 22 ma at 330 volts is 7.26
> watts max. average power, not 2.75 watts.
> OK baaaaack to basics

NOTE THE WORD "Maximum"
these are individual items
you can have
Maximum voltage developed across the anode to cathode
or Maximum plate current
but you should not exceed Maximum plate power disipation

We as amateurs often ignore this and the result is short
tube life, and some times a bit of fire works as things melt
down. The surface area of the plate does not always indicate
accuratly the total power disipation, although this is often
the case. The mass of the plate and a lot of other factors have

to be taken into account.

This is the equivalent of wanting to go 100 MPH
get 40 miles to the gallon
all in a large 4 wheel drive

these may all be done but not all at the same time

\$0.02
ran out
de
ve6nap@oanet.com

End of glowbugs V1 #49

%%%% GlowBugs %%%%% GlowBugs %%%%% GlowBugs %%%%% GlowBugs %%%%%

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Created by **Steve Modena, AB4EL**
Comments and suggestions to **modena@SunSITE.unc.edu**
